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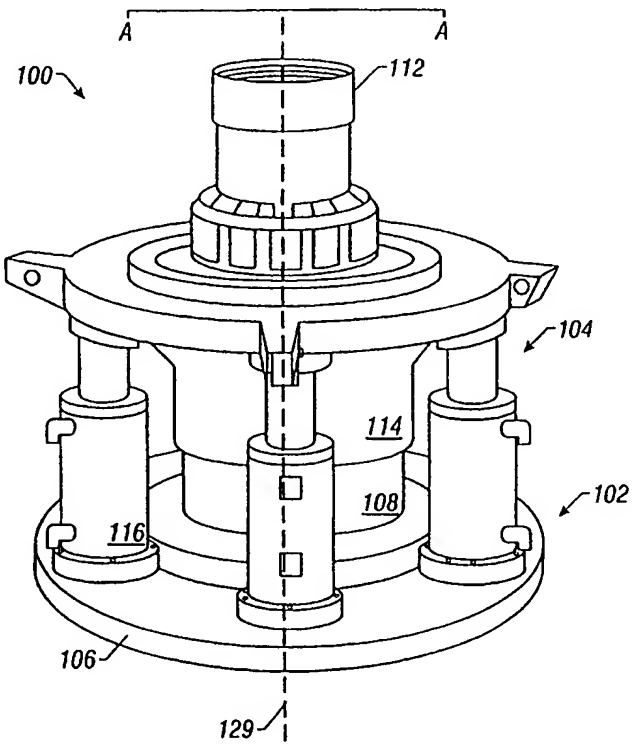
(54) Title: ELEVATING CASING SPIDER

(57) Abstract

An apparatus (100) for moving a tubular member (112) along a central axis (129) comprises a housing body (108) having a bore (110) running therethrough. A gripping member (147) slidably received in the bore defines a central opening for slidably receiving the tubular member (112). The gripping member (147) is movable between a first position to engage the tubular member and a second position to permit passage of the tubular member through the central opening. A mechanical device (126, 128) coupled to the housing body moves the housing body along the central axis.



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ELEVATING CASING SPIDER

BACKGROUND OF THE INVENTION

1. Technical Field

The invention relates generally to an apparatus having a bore through which well casings and other oilfield tubular members, e.g., drill stems and well liners, can be run into a well.

2. Background Art

Drilling and other petroleum operations conducted in deep water generally involve the use of a marine riser to connect a floating vessel's surface equipment to a blowout preventer stack on a subsea wellhead. The marine riser provides a conduit through which tools, e.g., drill string, and other items can be lowered through the subsea wellhead into a subsea well or through which fluid can be conducted from the subsea wellhead to the vessel. During an offshore operation, it is usually desirable to keep the floating vessel on station, i.e., maintain the floating vessel relatively stationary about the subsea wellhead or other stationary body. Typically, a dynamic positioning system which employs active means of monitoring position combined with thruster control to hold a fixed position is used to keep the floating vessel on station.

Generally, a dynamically positioned vessel employed for deep water operations is subject to drive-off at all times. A drive-off situation may be caused by a number of reasons, some of which include problems with active means of monitoring position, failure of thrusters, power shutdown on vessel, and ocean current anomalies. In the event of a drive-off, the marine riser must be disconnected from the blowout preventer stack and raised to an elevation that will allow the vessel to move off without damaging the marine riser. Typically, an emergency disconnect system that is included with the vessel's blowout control system disconnects the marine riser. Then the riser tensioning system that supports the marine riser is controlled to elevate the marine riser.

The emergency disconnect system uses pre-programmed sequences which includes shearing a tubular member, e.g., a casing string, that is being run through the marine riser and blowout preventer stack, shutting-in the well, and disconnecting the marine riser from the blowout preventer stack. The current practice is to cut or shear the casing string with one shear ram and use another blind/shear ram to shut-in the well. To ensure that the well is properly shut-in, the cut or sheared casing string must be picked up or raised above the blind/shear ram to allow full closure of the blind/shear ram. To do this, the operator must have control of the casing string with the casing string being supported or hung by elevators which are connected to a traveling block that is raised or lowered by drawworks.

Obviously, the elevation of the marine riser and the casing string should be coordinated to ensure that the well is properly shut-in and the marine riser and casing string are at an elevation that will permit drive-off without causing any undue damage to the riser. Sometimes, it may happen that during an emergency disconnect situation, the casing string is hung off or resting in casing slips at the rotary table on the vessel. In such a situation where the casing string is not hung by elevators, there is no means of quickly elevating the casing string. If the casing string cannot be elevated, then there are chances that the well may not be properly shut-in. Therefore, to ensure that the well is properly shut-in, it is desirable to have a means of elevating the casing string that can be readily activated, especially during an emergency disconnect.

SUMMARY OF THE INVENTION

In general, in one aspect, an apparatus for moving a tubular member along a central axis comprises a housing body having a bore running therethrough. A gripping member slidably received in the bore defines a central opening for slidably receiving the tubular member. The gripping member is movable between a first position to engage the tubular member and a second position to permit passage of the tubular member through the central opening. A mechanical device is coupled to the housing body to move the housing body along the central axis.

Other features and advantages of the invention will be apparent from the following description and the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an elevation view of an elevating mechanism.

FIG. 2 is a cross section of the elevating mechanism shown in FIG. 1 along line A-A.

FIG. 3 is a cross section of a slip elevator coupled to a centralizer assembly.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG. 1 illustrates an elevating mechanism 100 which comprises a support base 102 and a spider assembly 104 mounted on the support base 102. The support base 102 includes a platform 106 and an annular body 108, which extends upwardly from the platform 106. The support base 102 may be set on a rotary table (not shown) on a rig floor (not shown) to allow the elevating mechanism 100 to be used in lieu of the rotary table to run a tubular member, e.g., casing string 112, into a well.

FIG. 2 shows a vertical cross section of the elevating mechanism 100. As shown, the previously illustrated spider assembly 104 includes a centralizer assembly 114 and hydraulic cylinders 116. The centralizer assembly 114 includes a housing body 118 having a flange 120 and a bore 122. The bore 122 is coextensive with a bore 110 in the annular body 108 of the previously illustrated support base 102. The housing body 118 includes an annular shoulder 124 that is supported on the upper end 126 of the annular body 108. The hydraulic cylinders 116 include cylinders 126 and rams 128 that are slidably received in the cylinders 126. The cylinders 126 are mounted on the platform 106 and the rams 128 are attached to the housing body 118.

Hydraulic pressure may be fed into the cylinders 126 to move the rams 128 relative to the cylinders 126. As the rams 128 move relative to the cylinders 126, the housing body 118 also moves relative to the annular body 108 or along a central axis 129. Lubricant, e.g., grease, is fed in between the housing body 118 and the annular body 108 through ports 130 in the housing body 118. The lubricant is provided to

reduce friction and wear as the housing body 118 moves relative to the annular body 108. The lubricant is sealed between the housing body 118 and the annular body 108 by seals 132 and plugs 134.

A support assembly 136 is disposed inside the bore 122 of the housing body 118. The support assembly 136 comprises a master bushing 138 and split adapter bushings 140. The master bushing 138 is supported on an annular shoulder 142 of the housing body 118. The split adapter bushings 140 are arranged in a circumferential array within the master bushing 138 and define a generally conical seat 144 for slidably receiving a gripping member 146. The gripping member 146 comprises two or more diametrically opposed gripping segments, e.g., casing slips 148. The casing slips 148 are arranged in a circular pattern and define an opening 150 for receiving the casing string 112.

The gripping elements 147 on the casing slips 148 engage the casing string 112 when the casing slips 148 are seated in the seat 144. As the casing slips 148 are lifted from the seat 144, the casing slips 148 may be moved radially outward to enlarge the opening 150 and release the casing string 112. Hooks 152 on the casing slips 148 may be engaged to facilitate lifting of the casing slips 148 from the seat 144 or placement of the casing slips 148 on the seat 144. The split adapter bushings 140 are removable and may be selected to make the seat 144 larger or smaller. In this way, the opening 150 defined by the casing slips 148 can be varied to receive different casing diameters.

In operation, the casing slips 148 are raised relative to the seat 144 such that the opening 150 is large enough to allow the casing 112 to be run therethrough. When it is desired to rest the casing 112 in the casing slips 148, the casing slips 148 are seated on the seat 144 so that the casing slips 148 firmly engages the casing 112. While the casing 112 is engaged by the casing slips 148, the hydraulic cylinders 108 may be operated to raise the housing body 118 and elevate the casing 112. The hydraulic cylinders 108 are operated by supplying fluid to the cylinders 126 at a pressure sufficient to move the rams 128, the centralizer assembly 114, and the loads supported on or by the centralizer assembly 114 upwardly. The centralizer assembly

114 is lowered when the fluid pressure in the cylinders 126 is relieved.

FIG. 3 shows a slip elevator 160 that may be used to move casing slips in and out of a seat in the previously illustrated centralizer assembly 114 (shown in FIG. 2). In the illustrated embodiment, the slip elevator 160 is coupled to move casing slips 162 in and out of a seat 164 that is defined by an adapter bushing 166. The adapter bushing 166 is supported on a master bushing 167 that may be mounted in the housing body 118 of the centralizer assembly 114 (shown in FIG. 2). The slip elevator 160 includes an annular body 168 which is mounted on piston assemblies, e.g., pneumatic cylinders 170. The annular body 168 has a flange 172 and a bore 174. The pneumatic cylinders 170 extend between the flange 172 and the adapter bushing 166. The bore 174 is aligned with the opening 176 defined by the casing slips 162, thus allowing a casing string to be lowered into or retrieved from the opening 176. The annular body 168 is coupled to the casing slips 162 by linkages 178 so that when the annular body 168 is moved by the pneumatic cylinders 170, the casing slips 162 are also moved. The linkages 178 are pivotally attached to the annular body 168 and the casing slips 162 so that the casing slips 162 pivot inwardly or outwardly to contract or enlarge the opening 176, respectively.

Referring back to FIGS. 1 and 2, during an offshore operation, the elevating mechanism 100 is supported on a rig floor on a floating vessel (not shown) that is positioned above a subsea well (not shown). The elevating mechanism 100 is used to run a casing string or the like from the vessel through a blowout preventer stack (not shown) on the seafloor into a subsea well in the conventional manner. While the casing string is being run to the seafloor, the casing slips 148 are raised relative to the seat 144 such that the opening 150 is large enough to allow the casing string to be run therethrough. The casing string may be lowered through the opening 150 by an elevator that is connected to a traveling block and operated by drawworks in the conventional manner. When it is desired to rest the casing string in the casing slips 148, the casing slips 148 are seated on the seat 144 so that the casing slips 148 firmly engage the casing string. The elevator may then be disconnected from the casing string.

If an emergency drive-off is necessitated while the casing string is resting in the casing slips 148, the elevating mechanism 100 may be operated to elevate the casing string. Typically, a blowout control system on the floating vessel would actuate shear rams in the blowout preventer stack to shear the casing string. Then, the hydraulic cylinders 108 (shown in FIG. 2) may be operated to raise the housing body 118 to elevate the casing string. When the casing string is elevated, the blowout control system may actuate blind or blind/shear rams in the blowout preventer stack to close-in the well. The control of the hydraulic cylinders 108 may be incorporated into the blowout preventer control system so that the same pre-programmed sequence that is used to operate the ram preventers is also used to actuate the hydraulic cylinders 108 to lift the housing body 118 and the casing string. Advantageously, the elevating mechanism 100 moves the sheared end of the casing string clear of the preventer bore so that the blind rams can properly close-in the well. The elevating mechanism 100 may also be operated to move the casing string to an elevation that will permit drive-off without damaging other components, such as the marine riser.

While the invention has been described with respect to a limited number of embodiments, those skilled in the art will appreciate numerous variations therefrom without departing from the spirit and scope of the invention. For example, other mechanical devices, e.g., screw thread, rack and pinion, linkages, or air bags, may be used in place of the hydraulic cylinders 108 to move the housing body 118 along the central axis.

CLAIMS

What is claimed is:

1. An apparatus for moving a tubular member along a central axis, comprising:
a housing body having a bore running therethrough;
a gripping member slidably received in the bore and defining a central opening for slidably receiving the tubular member, the gripping member being movable between a first position to engage the tubular member and a second position to permit passage of the tubular member through the central opening; and
a mechanical device coupled to the housing body for moving the housing body along the central axis.

2. The apparatus of claim 1, wherein the mechanical device comprises at least one piston slidably received in a cylinder, the piston being arranged to move relative along the central axis in response to fluid pressure in the cylinder.

3. The apparatus of claim 2, further comprising a base member and wherein the housing body is supported on the base member and movable relative to the base member.

4. The apparatus of claim 3, wherein the cylinder is mounted on the base member and the piston is attached to the housing body.

5. The apparatus of claim 1, further comprising a device for moving the gripping member between the first and second positions.

6. The apparatus of claim 5, wherein the gripping member comprises at least a pair of diametrically opposed gripping segments having gripping elements for gripping the tubular member.

7. The apparatus of claim 6, wherein the device for moving the gripping member comprises an annular body coupled to the gripping segments and a piston device for moving the annular body.

8. The apparatus of claim 7, wherein the annular body is pivotally coupled to the gripping segments such that the gripping segments move radially inward and outward as the piston device moves the annular body.

9. An apparatus for moving a tubular member along a central axis, comprising:
a base member;
a housing body movably supported on the base member, the housing body having a bore running therethrough;
a gripping member slidably received in the bore and defining a central opening for slidably receiving the tubular member, the gripping member being movable between a first position to engage the tubular member and a second position to permit passage of the tubular member through the central opening; and
a mechanical device having a piston member coupled to the housing body, the piston member being operable to move the housing body along the central axis.

10. The apparatus of claim 9, further comprising an elevator mechanism for moving the gripping member between the first and second positions.

11. The apparatus of claim 10, wherein the gripping member comprises at least a pair of diametrically opposed gripping segments and wherein the gripping segments define the central opening.

12. The apparatus of claim 11, wherein the device for moving the gripping member comprises an annular body coupled to the gripping segments and a piston device for moving the annular body.

13. The apparatus of claim 12, wherein the annular body is pivotally coupled to the gripping segments such that the gripping segments move radially inward and outward as the piston device moves the annular body.

14. An apparatus for moving a tubular member along a central axis, comprising:
a base member;
a housing body movably supported on the base member, the housing body having a bore running therethrough;
at least a pair of diametrically opposed gripping segments disposed in the bore, the gripping segments defining a central opening for slidably receiving the tubular member, the gripping segments being movable between a first position to engage the tubular member and a second position to permit passage of the tubular member through the central opening; and
a piston assembly having a cylinder member mounted on the base member and a piston member coupled to the housing body, the piston member being slidably received in the cylinder member, the piston member being operable to move the housing body along the central axis in response to fluid pressure in the cylinder member.

15. The apparatus of claim 14, further comprising an elevator mechanism for moving the gripping segments between the first and second positions.

16. The apparatus of claim 15, wherein the elevator mechanism is pivotally coupled to the gripping segments such that the gripping segments move radially inward or outward with respect to the central opening as the elevator mechanism moves the gripping segments between the first and second positions.

17. An apparatus for moving a tubular member along a central axis, comprising:

a housing body having a bore running therethrough;

a gripping member slidably received in the bore and defining a central opening for slidably receiving the tubular member, the gripping member being movable between a first position to engage the tubular member and a second position to permit passage of the tubular member through the central opening;

a lifting means for moving the gripping member between the first and second positions; and

a mechanical device coupled to the housing body for moving the housing body along the central axis.

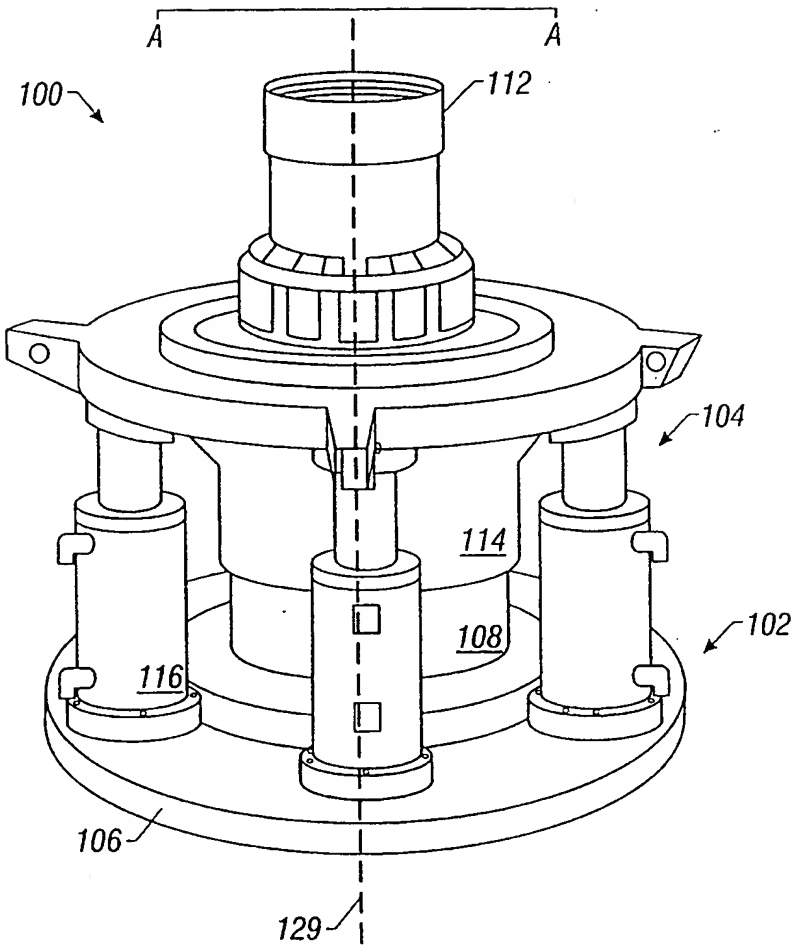
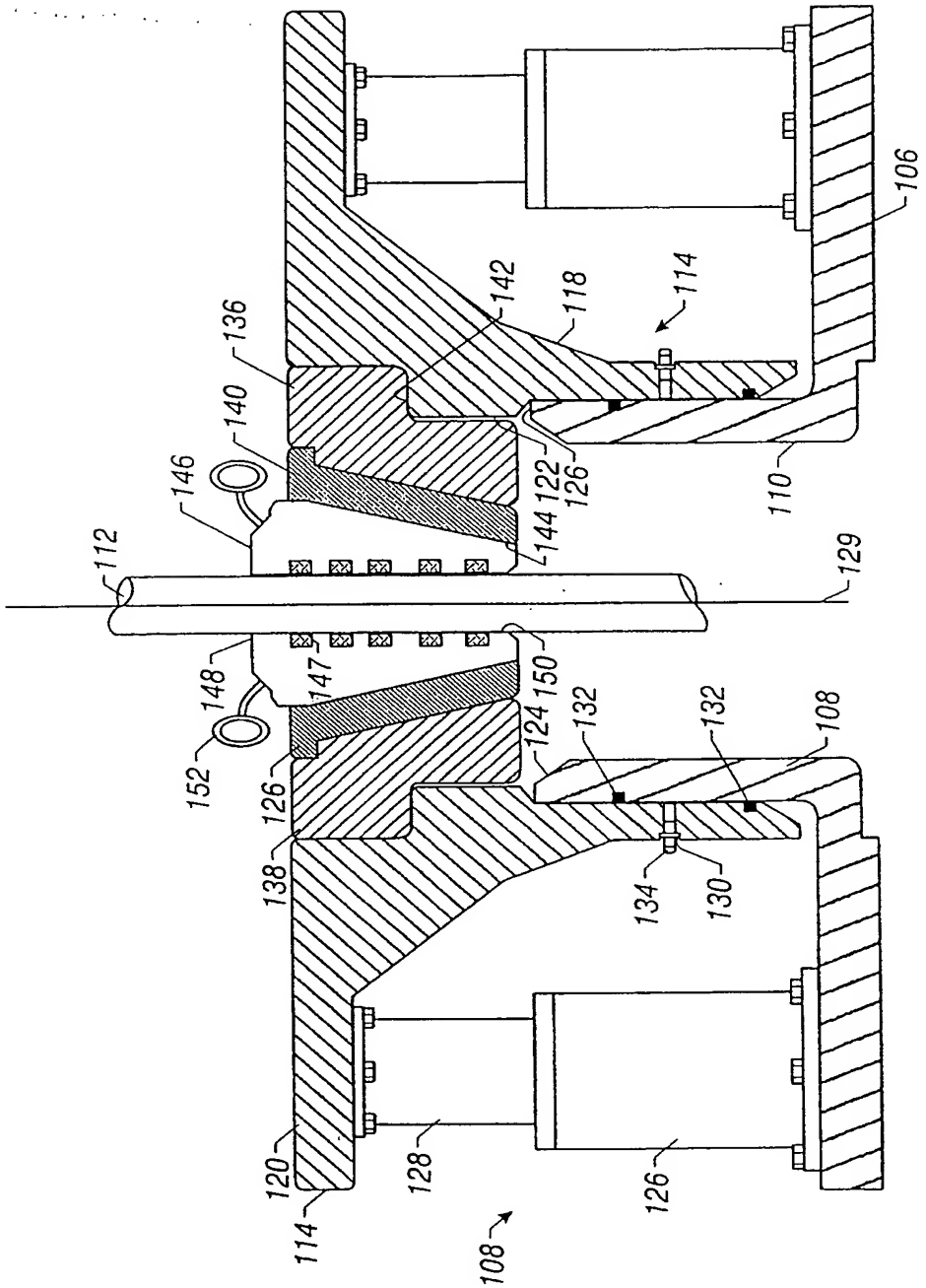


FIG. 1



(SECTION A-A)

FIG. 2

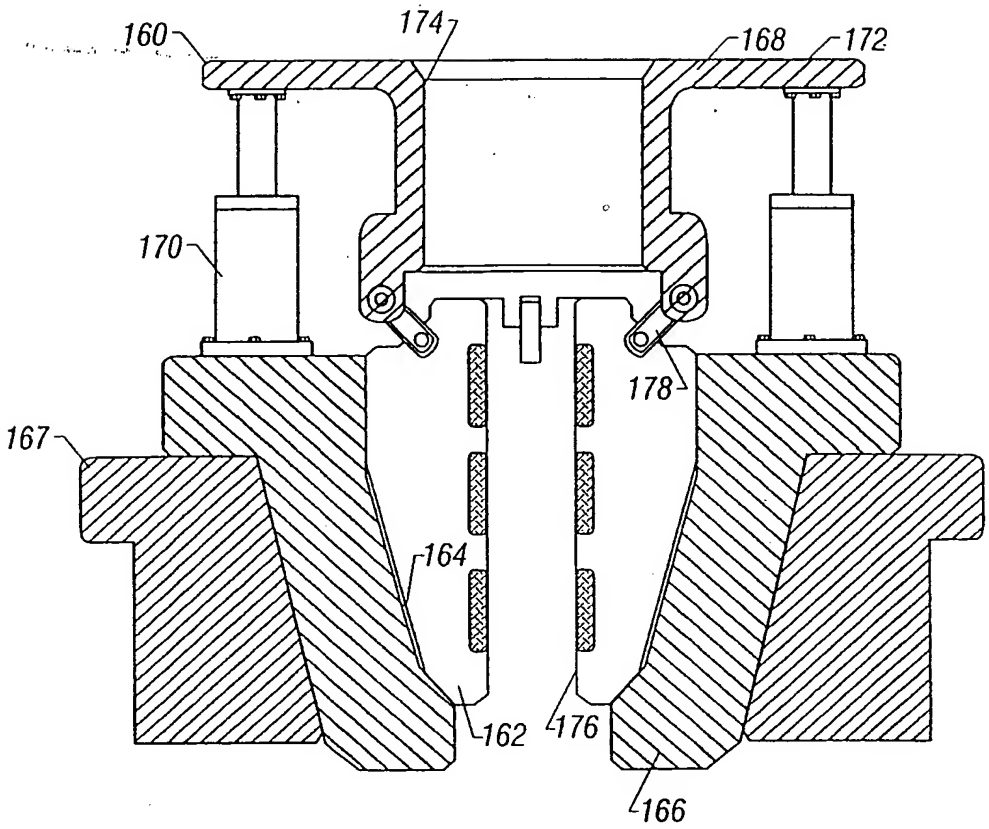


FIG. 3

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US99/18461

A. CLASSIFICATION OF SUBJECT MATTER
IPC(6) :E21B 19/08
US CL :166/77.4; 175/423
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 166/77.4, 75.14; 175/423

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 3,797,570 A (LEUTWYLER) 19 March 1974 (19/03/74), see Figures 1a-4.	1-17
X	US 4,715,456 A (POE, JR. et al) 29 December 1987 (29/12/87), see 1-7.	1-17
A	US 2,700,201 A (BANNISTER) 25 January 1955 (25/01/55), see Figure 2.	1-17
A	US 3,579,752 A (BROWN) 25 May 1971 (25/05/71), see Figures 1 and 3.	1-17
A	US 4,354,706 A (COYLE, SR.) 19 October 1982 (19/10/92), see Figures 1-3.	1-17

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

*	Special categories of cited documents:	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
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